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General Notes.

GEOLOGY AND PALEONTOLOGY.

Geological Survey of Missouri.—Mr. Arthur Winslow the State Geologist makes the following report of progress during the month of April to Governor Francis as President of the Board of Managers of the Department of Geology and Mines of Missouri: Early in the month field work was actively resumed. The examination of the zinc and lead deposits was taken up in Jasper and Newton counties, and detailed mapping is now in progress there. Examinations of iron ores have been made in Stoddard, Dent, Callaway, Cooper, Saline, St. Clair, Butler and Wayne counties. Field work on the clay deposits has been continued in St. Charles and St. Louis counties. In the office the proofs of the engraved Higginsville sheet and of the accompanying report have been corrected, and good progress has been made in the preparation and revision of the report on the mineral waters, the report on the iron ores and the report on the paleontology of the State.

For May Mr. Winslow makes the following report:

Much attention has been given to the study of the zinc and lead deposits and in this connection examinations have been made in Jasper, Newton, Lawrence, Greene and St. Francois counties. In addition detailed mapping has been prosecuted in Jasper county and about 140 square miles have been covered during the month. Further, there has been collected in Jasper county a large number of charts, showing the location of mining properties, shafts and ore bodies, and a great amount of statistical matter relating to these. The material thus acquired will be used in the preparation of the general report upon the zinc and lead deposits and also in the special report which will accompany the maps of Jasper county now being prepared. In connection with the examination of the iron ores stratigraphic studies of the Ozark region have been prosecuted along the Big Piny and Gasconade Rivers, in Texas, Pulaski, Phelps, Maries, Osage and Gasconade counties. In addition iron ore deposits have been inspected in Ripley, Carter, Wayne and Butler counties. The clays of the State have been subjects of further examination in both the field and the laboratory, deposits having been visited in St. Louis, Jefferson, Washington, Madison, Bollinger, Carroll, Chariton and Randolph counties. The study of the Quaternary geology of the State has been prosecuted in Jackson, Lafayette, Johnson, Macon, Randolph and Saline counties. In Greene and Polk counties a small amount of systematic geological mapping has been done. The excessive rains during the month have not only made all the field work difficult and disagreeable, but have made certain work impossible and have materially retarded the progress in other directions. It is greatly to the credit of the assistants of the Survey that, notwithstanding the hardships endured and the difficulties overcome, such advance has been made. In the office the preparation of reports has been constantly in progress. This includes the original composition, the revision and preparation for the printer, the correction of proof, the drawing of maps and illustrations. The reports which have thus specially received attention during the past month are the report on the Iron Ores, the report on the Mineral Waters, the report on Palaeontology, the report on the Higginsville sheet, the reports on the Warrensburg, Iron Mountain and Mine La Motte sheets and the report on the Crystalline Rocks.

For June the following report is made:

The excellent weather which has prevailed since the early part of the month has much facilitated the progress of work in the field. Zinc and lead deposits have been examined in Franklin, St. Francois, Madison, Washington, Crawford, Jasper, Lawrence and Newton counties; about 110 square miles have, in addition, been mapped in detail in Jasper county. Clays have been examined in Adair, Randolph, Warren, Montgomery, Audrain, Jackson, Lafayette, Saline, Howard, Callaway, and Pike counties. Iron ores have been inspected in Mississippi, Dunklin, Scott, Ripley, Butler, Carter, Shannon, Howell, Oregon and Ozark counties and the stratigraphy of the country along Current river has been studied in connection with these deposits.

The mapping of the crystalline rocks has been resumed in Wayne, Iron and Reynolds counties. The study of the Quaternary formations has been prosecuted in Saline, Howard, Boone, Callaway, Montgomery, Warren, Ray, Macon and Randolph counties and the terminal line of the drift has been traced almost entirely across the State.

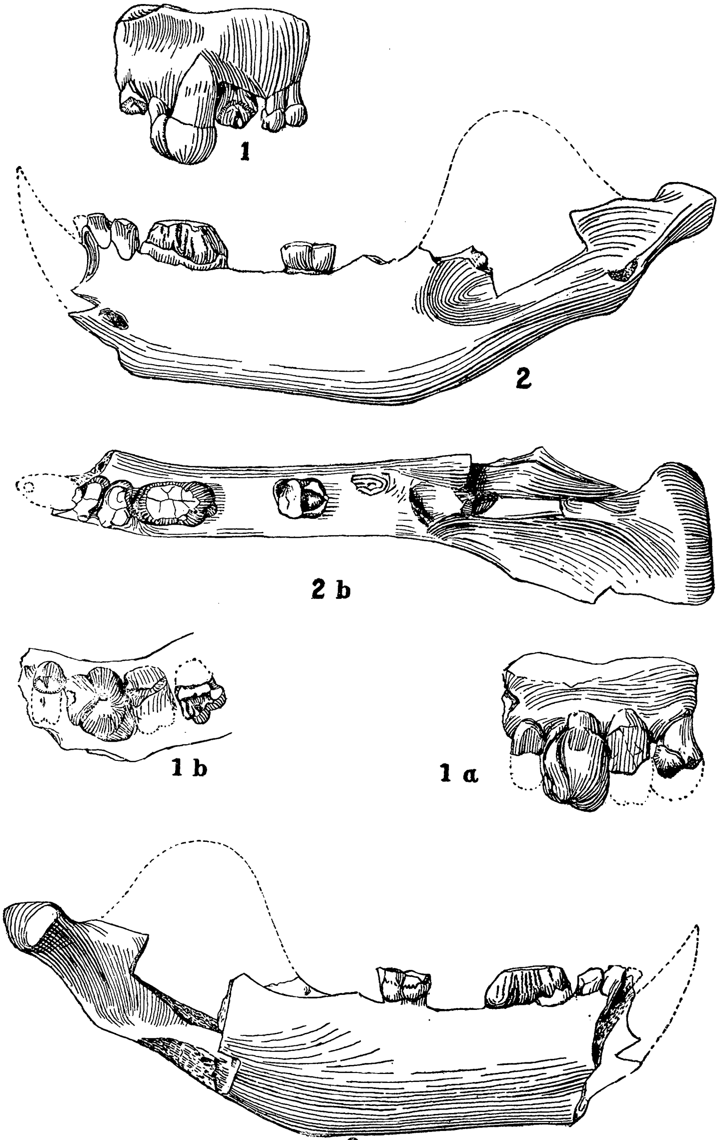
In the office the preparation of the reports on the iron ores, on the zinc and lead ores and on the paleontology has continued and the manuscript of the report on the mineral waters has nearly all been transmitted for revision and preparation for the printer; the Higginsville map and section sheet and the accompanying report have been printed and will soon be ready for distribution.

During the past month, arrangements have been perfected for intimate cooperation between the World's Fair Commission and the Geological Survey, such that the material accumulated and the great amount of knowledge acquired by the latter organization concerning the geology and the mineral deposits of the State will be applied in the interests of the prospective exhibit in Chicago. The plans adopted and the progress already made in the execution of these plans yield abundant promise that the display in this department will be of the greatest possible credit and advantage to the State.

The Pacific Cable Survey.—The United States steamer Thetis has been making a second survey for the proposed cable between San Francisco and Honolulu, and met with far greater success than was had in the first survey, made by the steamer Albatross six months ago, when the line of survey was from a point on Monterey Bay, direct to Honolulu. The Thetis made a start from Point Conception, 220 miles south of San Francisco and thirty-eight miles west of the town of Santa Barbara, and at the head of Santa Barbara channel. At the point there is high ground and the water shoals off on a mud bottom. As a landing place for a submarine cable everything is favorable. The course taken by the Thetis was nearly due southwest and by way of the great circle. Soundings were made every two miles until 900 fathoms was reached. As the steamer proceeded toward the Hawaiian islands the depth of water gradually increased until 3000 fathoms was averaged for miles. Soundings were taken at intervals of ten miles where the bottom was found of a level nature and where irregular or undulating at distances down to half a mile. The greatest depth reached was 3228 fathoms when about 300 miles from Hilo on the island of Hawaii, which is marked as the landing-place at the islands. Thirty-five miles from Hilo the water shoaled to 1000 fathoms, and from that gradually on to twenty fathoms. There is more water at Hilo than at Point Conception. The island of Hawaii is about 200 miles southeast of Honolulu and can be connected by a short cable. By the Thetis survey the cable will run 2060 miles. The Albatross survey is about fifty miles longer, but not quite as practicable owing to the bottom of the sea being very irregular over a greater part of the first survey.

Fourth Note on the Dinosauria of the Laramie.—Previous notes on this subject have appeared in the NATURALIST for 1888 p. 1108; 1889 p. 715; and 1889 p. 904. In the present communication

PLATE XXII.



Thlæodon padanicus, Cope.

two additional forms are described, and rectifications of synonomy are made.

MANOSPONDYLUS GIGAS.—Gen. et sp. nov. *Char. Gen.*—Dorsal vertebræ with short anteroposterior diameter, and gently concave articular faces. Neurapophyses coössified. At the superior part of the centrum, a deep entering fossa; surfaces of circumference otherwise uninterrupted. Tissue of centrum at borders of articular faces coarsely vesicular. The form of these vertebræ indicates that this genus is allied to the Agathaumidæ rather than the Hadrosauridæ. No genus of either family known to me possesses the fossæ at the base of the neural arch.

Char. specif.—Dorsal centrum a little deeper than wide. Lateral surfaces smooth.

	Diameters of centrum.	mm.
Articular face	vertical	205
	transverse	200
Anteroposterior		90

Two dorsal vertebræ are the only remains which I can refer to this species, which is the most gigantic of the Dinosauria of the Laramie known to me. In the same neighborhood, but several hundred yards distant, I discovered a huge supratemporal bone, which differs from those of some of the allied genera in having a simple undulate free border, without tuberosities or processes. Its form is similar to that of Agathaumas, *i. e.* as broad as long posterior to the quadrate suture. There is no evidence that it belongs to this species.

CLAORHYNCHUS TRIHEDRUS.—Gen. et. sp. nov. *Char. Gen.*—This genus is established on a rostral and predentary bones of a species of the Agathaumidæ, which were found together and with the fragments of a massive supratemporal bone. They are distinguished by their absolutely flat inferior faces, there being no alveolar ridges as in the forms described by Marsh. They are not compressed but are as wide as long. They are not adapted to the muzzle of Monoclonius, where the rostral bone is compressed. (*M. sphenocerus.*)

Char. specif.—Rostral and predentary bones as wide as long, with flat inferior face and rounded superior median angle. Transverse diameter rather exceeding the vertical. Sides convex. All the surfaces furrowed by coarse grooves which terminate in foramina.

The short wide form of this species differs from that seen in the species of the family Agathaumidæ which have been yet described.

The extremity of the beak had apparently a horny sheath and was adapted for crushing comparatively hard substances.

Agathaumas Cope—Professor Marsh (Amer. Journ. Sci. Arts, 1892, p. 83) endeavors to show that this genus differs from any of those described by him by quoting characters from my description of the type specimen. Since my last description of that genus was published (1875), I have studied part of a skeleton obtained by Dr. J. L. Wortman in Dakota, of which the parts are undistinguishable from those of the *Agathaumas silvestre.* These include an ilium in much better preservation than that of the type, and I am enabled to correct some of the statements contained in my original description. I stated that there is no facet for the pubis at the front of the acetabulum. The surface at this point is broken in both of my specimens, but it is altogether probable that the structure at this point does not differ from that of the allied forms. The ischiadic suture is in like manner obscured by injuries in the type specimen. The Dakota specimen is perfectly preserved at this point, and displays a large convex sutural surface for the ischium, thus showing that my original description was imperfect in this point. The number of sacral vertebræ in the original specimen is not exactly determinable—only approximately, but this region is identical in character with that of other members of the family. That the *Agathaumas silvestre* is one of the largest species of the family is indicated by the following measurements of the Dakota specimen:

		mm.
Length of ilium		1465
Length of tibia		940
Diameters of tibia	greatest proximal	325
	greatest distal	290
Diameters of dorsal centrum	anteroposterior	95
	vertical	138
	transverse	137

The centrum of the dorsal vertebra is slightly opisthocœlous.

Pteropelyx Cope—This genus was described by me in The American Naturalist for October, 1889 p. 904 (published March 5th, 1890), It has been subsequently named by Marsh, Claosaurus, in the American Journ. Sci. Arts. for May, 1890 (p. 423).—E. D. Cope.

On a New Genus of Mammalia from the Laramie Formation.—In 1881 I had the pleasure of announcing the existence of Mammalia in the Laramie formation, and described the new genus and species of Multituberculata, *Meniscoëssus conquistus.* Since then Prof. Marsh has described several species from the same formation, exaggerating the number very considerably, as has been precisely shown by Prof. Osborn. I now introduce to notice another species, which represents a new and peculiar family of Marsupialia or Monotremata, and which throws considerable new light on some of the species described by Prof. Marsh. The material in my possession consists of a mandibular ramus of the left side which is nearly complete, and which contains three premolars with alveoli of the anterior premolar and canine, and a fragment of the last true molar; with another true molar. About one hundred feet from this specimen was found a part of the right maxillary bone containing an entire last premolar with parts of the penultimate premolar, and first true molar; a molar lacking the protocone was found close to this fragment, and evidently belongs to it. So close is the resemblance in character between the teeth of the two jaws, that I am satisfied that they belong to the same species, and probably to the same individual.

THLÆODON PADANICUS.—Gen. et. sp. nov. *Char. Gen.*—Dental formula, I. $\frac{?}{?}$; C $\frac{?}{1}$; P. m. $\frac{?\,?}{4}$; M. $\frac{?}{?3}$. Inferior canine robust, one rooted. Premolars $_{1234}$ two-rooted; $\frac{1-2}{}$ three-rooted. Posterior premolar each jaw with robust, convex, swollen crowns, without heels or accessory cusps. Superior true molar tritubercular, with large internal cusps, and small external cusps; intermediate cusps present. Inferior premolars 2–4 with transverse crowns. Inferior true molar with anterior trigon and posterior basin; the former transverse, the latter with posterior angular cusps.

The genus Thlæodon represents apparently a new type of Marsupialia, or possibly of Monotremata. In the entire absence of the mandibular angle it resembles Ornithorhynchus, and also the genus Triconodon Owen, and several other genera of the Jurassic system. It differs from most of the genera of the Jurassic non-Multituberculata, in the normal number of its teeth, which apparently agrees with that typical of the class; viz. I. 3; C. 1; Pm. 4; M. 3. The number of true molars may be four, but the space which is preserved in the lower jaw is as appropriate to three; either number requiring that the teeth should present somewhat unequal dimensions. The form in any case indicates an ancient and inferior type, specialized in the direction of dental reduction, and in the development of a molar or crushing type of premolars. The true molars are also specialized in the direction of modern forms, the superior being tritubercular, and the inferior quinquetubercular, with trigon and heel. The genus may be referred to a new family, the Thlæodontidæ, with the following definition. Mandible without angle, but with inflected inferior border, and a coronoid process. Molars $\frac{3}{5}$-tubercular; premolars simple. Canines well developed; incisors reduced.

The discovery of this genus enables me to suggest a further reduction on the number of genera named (but not described) by Prof. Marsh. It is now indicated that the forms with only the simple and robust premolars which have been described by Marsh under the name of Stagodon, belong to the animals of which molars only are described under the names of Didelphops, Didelphodon, etc., and should be referred to identical genera and species. What the simple-rooted tooth which served as the type of Marsh's Stagodon really is, remains to be ascertained, but some of the premolars of Mammalia described by him under that name resemble those of Thlæodon, although much inferior in size and less robust than are those of *T. padanicus.* The largest species described by Marsh, under the name of *Stagodon validus*[1] is not very different in size from the *T. padanicus*, but the number of premolars is probably smaller, or if equal, the anterior ones are longitudinal and not transverse. The description of Marsh is valuable as indicating the character of the incisors, a point not elucidated by my specimen. Marsh refers these forms to a family Stagodontidæ[2] which he does not define; moreover the generic character of the real Stagodon remains undescribed.

The widely transverse condyle of Thlæodon shows that the movement of the lower jaw in mastication was vertical or orthal, as in the opossums, and not propalinal as in the Multituberculata, or loose as in the modern Monotremata. The true position of the family must, however, remain doubtful until other portions of the skeleton are discovered. The genus Thlæodon may be simply a form of Didelphyidæ with simple robust premolars.

Char. specif.—The surface of attrition of the superior premolars is oblique to the vertical axis of the crowns, the latter spreading outward and downward in relation to the maxillary bone. The crown of the first premolar is very much larger than that of the second, and is subquadrilobate. This form results from the presence of three grooves which rise from the interradical spaces, but which do not attain the summit of the crown. The latter is obtusely rounded, with the anteroexternal diameter in excess of the anterointernal diameter.

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[1] Amer. Journ. Sci. Arts, 1889, August, p. 178. Pl. vii, figs 22–5.

[2] Op. cit. 1892, March 256. Pl. viii, fig. 7.

The enamel is coarsely wrinkled when not worn by use. The roots are encased in a layer of cementum, which forms a narrow ledge round the base of the crown. The true molar preserved has a transverse triangular crown. The paracone is conical and the metacone is compressed so that its worn section is anteroposterior. A longitudinal ridge notched in the middle occupies the space between the paracone and metacone. The protocone is represented by a large worn surface, whose interior extremity is unfortunately broken away. The paraconule forms a narrow transverse crest which passes in front of the paracone. The metaconule on the other hand is within and anterior to the metacone.

The alveolus is all that indicates the character of the inferior canine. It is deep, extending to the base of the ramus, and is directed with a straight axis, a little forward of upward. The side is longitudinally keeled near the fundus on the external side. The anterior three inferior premolars are very narrow, extending transversely across the alveolar line, with divergent roots. The crowns are so worn that their structure is not determinable. The first inferior premolar, is very robust, its crown equaling those of the other three in anteroposterior diameter. The horizontal section of the crown is a longitudinal ovoid. The anterior border is broadly rounded; the posterior bilobate, the internal lobe more prominent than the external. There are two roots, of which the posterior is grooved on the internal side, giving the appearance of three roots, a form to which the alveolus is adapted. Two grooves rise from these grooves on the inner side of the crown, and there are two or three obscure grooves on the external side. Enamel rough. Roots with cementum layer, which forms a narrow ledge round the base of the crown. Like the superior true molar preserved, the inferior truemolar is remarkable for its small size as compared with the premolars. It is of robust form, presenting anteriorly a transverse trigon, which is worn to a uniform surface in the specimen, but displays traces of the paracone and metacone. A strong cingulum marks the external part of the anterior base of the protocone. The heel is short and wide, and has a raised border surrounding a basin. The border consists of external and internal compressed cusps, and a small median one soon confluent with the internal one. No cingula other than the one described. The last inferior molar has left only the base of its heel, which was evidently more elongate than that of the other molars. The coronoid process has a base much extended anteroposteriorly; it is broken off. The masseteric fossa has a strong anterior rib border, but the inferior border is very prominent, being a horizontal ledge extension of the inferior face of the ramus, which rises gradually to the internal extremity of the condyle. The condyle is unusually extended transversely for the size of the ramus; the extension being principally external. The internal inflection commences below the posterior base of the coronoid process and its border extends diagonally inwards and anteriorly. It bounds a large dental foramen and canal.

Measurements.		mm.
Length of ramus from canine alveolus to and including condyle		75
Length from last true molar to and including condyle		37
Length of inferior premolar series		17
Diameters of last premolar	transverse	6
	anteroposterior	8
Diameters of true molar	transverse	4.5
	anteroposterior	5
Depth of ramus at premolar 1		15
Depth of ramus at molar 3		16
Transverse diameter of condyle		16
Diameters superior premolar 1	transverse	8
	anteroposterior	7
Anteroposterior diameter true molar ? 2		5

The jaws are about the size of those of the gray fox, *Vulpes cinereoargentatus.*

Prof. Marsh (Amer. Jour. Sci. Arts, March, 1892, p. 251) regards the fauna of the Laramie as widely different from that of the Puerco, which succeeded it. He says "the more the two are compared the stronger becomes the contrast between them." It is true that no Ungulata have been yet found in the Laramie, while they abound in the Puerco, but we cannot be sure that they will not yet be found; the probabilities are that they existed during the Laramie, and that it is due to accident that they have not been obtained. But the Multituberculata of the two faunæ are much alike. Thus the *Dipriodon lunatus* (Marsh l. c., Pl. v, fig. 7,) appears to be a species of Ptilodus Cope, and the *Cimolodon nitidus* (l. c. vi, fig. 9,) is either a species of that genus or of Neoplagiaulax Lem., both genera characteristic of the Puerco.

EXPLANATION OF PLATE.

All the figures natural size.

Fig. 1. Fragment of maxillary bone external view: 1 *a* internal view; 1 *b* inferior view.

Fig. 2. Left mandibular ramus external view: 2 *a* internal view; 2 *b* superior view.—E. D. COPE.

What is Lophiodon?—Under this generic head the French, German and Swiss palæontologists have gathered a number of very diverse types of molar teeth. In the recent memoir[1] of Prof. Rütimeyer upon the Fauna of Egerkingen and his earlier memoir[2] we find a series of beautiful figures in which the distinctive characters are very clearly brought out. They leave little doubt in my mind that the genus *Lophiodon* which has long been a sort of corral for all the fossil lophodont perissodactyls of Europe, in which the premolars are not like the molars, should be split up not only into a number of genera, but that these genera should be placed in a number of distinct families. This union of these forms under one genus, has been a natural result of the isolated condition in which the types have been found and the re-determination of these forms is only rendered possible by the complete series of upper and lower teeth which are now found in the Eocene.

I am not at present in a position to attempt to review these forms thoroughly for I have not at hand the types, nor all the early literature, nor the recent memoir of M. Filhol.[3] I merely offer a few preliminary notes, availing myself of the admirable figures and descriptions of Rütimeyer.

Turn first to Prof. Rütimeyer's later volumes:

The references are to his plates. *Lophiodon annectens* Rütimeyer, (Taf. I, fig. 12–13). These molars have the same characteristics as those of the primitive Tapirs, and bear a most striking resemblance to those of *Isectolophus annectens*[4] from the American Eocene; this resemblance extends not only to the relations of the cusps and crests but to the development of a complete cingulum around the crown.

Lophiodon cartieri Rütimeyer, (Taf. I, fig 12). The characteristics of this type (Fig. 10 *b*) are that the protoloph springs from the paracone, the metaloph rises from a point slightly in front of the metacone, the paracone is conic while the metacone is slightly flattened upon the outer surface, the parastyle is low, the cingulum is feebly developed below the paracone. These are the characteristics of the series to which *Heptodon* Cope and *Helaletes*[5] Marsh belong. The premolars referred by Prof. Rütimeyer to *L. annectens* are very similar to those of *H.* (*Desmatotherium*) *guyotii* Scott, from the Bridger Eocene.

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[1] "Die Eocäne Säugethier Welt von Egerkingen," Zurich, 1891.

[2] "Eocæne Säugethiere aus dem Gebiet des Schweizerischen Jura," 1862.

[3] Filhol. "Vertébrates fossiles d'Issel," Mém. Soc. Géol. de France. 1888.

[4] See Osborn, "Mammalia of the Uinta Formation," Plate X, fig. 1.

[5] *Desmatotherium* Scott is a synonym of Helaletes. See Bull. No. 3, E. M. Museum, 1883, Plate viii, fig. 3.

Lophiodon isselensis Fischer, (Taf. I, fig. 9). This is a distinct type. The figure agrees closely with that given by Gaudry[6] of a complete series of upper molars. This exact type of molar has not been found in America. So far as known the true *Lophiodon*, like *Palæotherium*, was confined to Europe. The characteristics of this *Lophiodon* molar are that both paracone and metacone are conic and nearly of the same size, in this respect it resembles the Tapir, but it differs widely from the tapir in the origin of the transverse crests, for the protoloph passes up to the paracone and the metaloph springs from the metacone, whereas in the Tapir these crests spring from the anterior base of the external cusps.

Turn now to Prof. Rütimeyer's earlier volume:

Lophiodon rhinocerodes Rütimeyer, (Taf. I, fig. 4). The type molar of this species is, as the name implies, of the true rhinocerotine pattern. It is closely similar to the first upper molar of *Amynodon* (*Orthocynodon*) *antiquus* from the upper division of the Bridger Eocene, as figured by Scott and Osborn,[7] except that the tooth is much larger and the parastyle is more prominent. The lower canine is quite different. This form therefore is distinct from *Amynodon* in several features.

Lophiodon tapiroides Cuvier, (Tab. II, figs. 15–26). The first and second molars have nearly the true tapir pattern. The protoloph joins the robust parastyle. The metaloph rises half way between the paracone and metacone. The third molar, however, is not tapirine for the ectoloph is abbreviated as in the rhinocerotine type, in *L. isselensis*, and in *Heptodon*.

Lophiodon parisiensis Gervais, (Tab. III, fig. 27–35). This molar has no exact counterpart in the American Eocene.

Lophiodon cartieri Rütimeyer, (Taf. III, fig. 38–40). These molars are precisely similar to those of the middle sized *Hyrachyus*, *H. agrarius* of the Bridger Eocene.

Egerkingen, Species.	Bridger, Nearest Allied Form.	Family.
L. annectens	Isectolophus annectens	Tapiridæ
L. cartieri	Hyrachyus eximius	Hyracodontidæ
L. rhinocerodes	Amynodon antiquus	Amynodontidæ or Rhinocerotidæ
L. isselensis	unique	Lophiodontidæ.
L. parisiensis	"	? "
L. tapiroides	"	"

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[6] "Enchainements du Monde Animal," fig. 72.

[7] E. M. Museum Bulletin, No. 3, Pl. V, fig. 2, 1883.

The conclusions here arrived at are: First, that the Egerkingen fauna, which Prof. Rütimeyer has already shown to contain a surprising number of New World forms, embraces also the true *Hyrachyus* and *Isectolophus* types, also a form ancestral to the Rhinocerotidæ. Second that the character of the external cusps and the point of union of the transverse crests with them are so diverse that some of the different species referred to *Lophiodon* probably belong to distinct genera. I find that the forms and relations of these cusps and crests are absolutely constant and distinctive in the families of American lophodonts and it is highly improbable that the single genus *Lophiodon* should embrace *specific* molar types as different from each other as the *family* molar types are in the American Eocone.

The question, what is Lophiodon? is yet to be answered. Where does it stand with reference to the tapirs, rhinoceroses, hyracodonts?—HENRY F. OSBORN, American Museum of Natural History, New York, July 12th, 1892.